



# The dog (*Canis familiaris*) as part of the family: a pilot study on the analysis of dog bond to all the owners

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**Abstract:** The aim of the current study was to evaluate whether dogs living in multi-member families show a stronger bond towards a specific person, and, if it is the case, which characteristics of the owner or of their relationship may lead to such preference.

Eleven dogs were tested using a modified version of Ainsworth Strange Situation Test where all the family members (five 2-member, two 3-member, and four 4-member families) were contemporaneously present. The duration of 19 non-social (proximity to door/chair, behaviors towards door/chair/shoe, oriented to door, exploration, locomotion, passive behavior, individual play, vocalisations, and whining) and social (attention seeking, physical contact, following, proximity, approach, and visual orientation) dog behaviors was measured. The latter were assessed towards each participant. A questionnaire, including the Lexington Attachment to Pets Scale, was used to gather information on the relationship between people and the tested dog.

The analysis of data revealed that most dogs ( $n = 8$ ; 72.7%) living in a multi-member family show a stronger bond to a specific member. Owners usually (75.0%) were able to identify the person the dog was more bonded to. It was not found a correlation between the level of attachment of a specific owner to the dog and the bond of this dog to that specific owner ( $57.12 \pm 15.42$  versus  $58.00 \pm 18.95$ ;  $F = 0.00$ ;  $p = 0.955$ ). Among dogs who showed a preference, the majority ( $n = 6$ ; 75.0%) preferred people who managed the dogs almost totally by themselves; for the remaining two, the preferred person was the one within the family who dealt with walking and food or walking and play. Therefore, walking the dog seems to increase the likelihood of establishing a strong bond with the dog.

**Key Words:** Ainsworth Strange Situation test, behavior, bond, dog, family, owner.

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## Introduction

In the 1950's John Bowlby (1988), starting from psychoanalytic concepts and ethology, elaborated a theory of attachment that was valid for all mammals. Attachment bonds, defined as an affectional tie enduring over time, is formed by one person or animal between himself and another specific one (Ainsworth & Bell, 1970). The behavioral test commonly used to study the child's attachment to the mother is called Ainsworth's Strange Situation Test (ASST) (Ainsworth & Bell, 1970).

*Canis familiaris* is a highly social species. As the ecological niche of domestic dogs is the human social environment, a variety of studies concerning dog behavior in relation to humans were developed. Topàl and colleagues (1998), assuming that dog-owner relationship resembles child-caregiver one, were the first who analysed the dog-human bond as an attachment by using a modified version of the ASST. Adult dog's behavior during the separation from the owner as well as upon their reunion suggested that the ASST is suitable to provide information regarding the dog-human relationship.

Few studies have investigated dog-dog attachment using the ASST (Mariti et al., 2017; 2014).

Research has instead focused on the relationship between a dog and a specific person, namely the owner (for a review see Payne et al., 2015). There is now scientific evidence that adult dogs can use their owner as a secure base (Mariti et al., 2013), and they can form new interspecific attachment bonds even after the breaking of previous ones (Gácsi et al., 2001). However, many dogs live in multi-member families, and they relate to all members of the fostering family.

The aim of the current study was to evaluate whether dogs living in multi-member families show a higher attachment to a specific person, and, if it is the case, which characteristics of the owner or their relationship may lead to such preference.

In order to do that, all dogs were tested using a modified version of ASST where all the family member were contemporaneously present. Besides participating in the behavioral test, each family member filled in a questionnaire to gather information on his/her relationship with the examined dog.

## Materials and methods

### *Subjects*

Eleven families and their dogs participated in the experiment. The families were all volunteers and they were recruited by personal contacts.

Dog owners were 19 women and 13 men, whose ages ranged from 7 to 61 years.

Table 6, 7 and 8 report the characteristics of families and family members participating at this study.

Dogs were 9 females and 2 males, whose age varied from 13 to 108 months. They were: 3 Labrador Retrievers, 1 Border Collie, 1 Australian Shepherd, 1 Dalmatian, 1 Beagle, 1 Pug, 1 Miniature Poodle, and 2 mixed-breeds. None of the female dogs were in oestrus, nor were they pregnant at or around the time of testing. The inclusion criteria for tested dogs were: being more than 12 months old, having lived with the families for more than 6 months, being used to a wide variety of different environments and people (which meant no marked fear or aggression to strangers, for safety reasons).

### *Experimental setting*

The experimental environment was a relatively bare room, unfamiliar to the dogs, at the Department of Veterinary Sciences - University of Pisa (Italy). The room (4.50 x 4.30m) was prepared to match as much as possible the requirements described in the Ainsworth Strange Situation Test, especially in its version modified for dogs. The room was equipped with: chairs, in semicircle, in a number equal to participants (all the family members plus the stranger); a water bowl; three dog toys (a ball, a puppet and a rope); a table to leave the leash on; one door, around which it was drawn a 1 meter radius semicircle; two videocameras (JVC® GZ-MG 130E) to record the whole test. One videocamera was oriented to the door and the surrounding area, while the other one recorded the whole room.

### *Procedure*

Procedures used until now for the study of dog attachment to people slightly differed one from another. For the specific aim of the current research, some changes were made, especially related to the number of people participating at the same time.

All the family members and a stranger participated contemporaneously in the test. The stranger was always played by the same woman, who had never met the dog before. The stranger also acted

as test leader, guiding other participants throughout the test; when the stranger was outside the room, instructions were given using a low voice from outside.

The participants were asked not to draw the attention of the dog and to remain seated during the whole test, except when they had to leave or come back in the room, and when they were asked to stimulate the dog to play.

All participants brought a shoe with them as a personal object. The shoe of each participant, before the experiment began, was put in a plastic bag on the chair of the person seated on the left of the shoe owner.

The entire procedure comprised two consecutive phases: pre-experimental phase and experimental phase, the latter divided into 5 episodes plus an introductory episode. Episodes 2 and 3 were repeated for each participant (all family member plus the stranger), therefore the total duration of the test varied from a minimum of 23'22", when participants were three (two family members plus the stranger), to a maximum of 30'45", when participants were five. The leaving order of the family members was decided randomly before the beginning of the test, except for the stranger, who was always the last person leaving the room.

*Pre-experimental phase:* all the family members were escorted to a waiting room and asked to fill in a questionnaire in order to gain background information on: characteristics of the dog and the environment where he/she was living, personal details of the respondent, kind of activity involving the respondent together with the dog, and the Lexington Attachment to Pets Scale (L.A.P.S.) (Johnson et al., 1992; Marinelli et al., 2007).

The procedure was briefly described to the family members before the test. The specific aim of this study was not disclosed until the end of the test, in order to avoid possible influences on the participants' responses and behavior; the owners were told that the study aimed at investigating the exploratory behavior of dogs in an unfamiliar environment.

*Experimental phase:*

*Introductory episode:* all family members, stranger and dog entered in the experimental room. Participants sat on the chairs as previously established. The dog was unleashed and set free to explore the room. The leash was laid on the table.

*Episode 1:* Family members, stranger and dog (3 min). Participants could talk to each other and interact with the dog only if the latter was seeking for their attention. At the end of the third minute a person left the room.

*Episode 2:* A participant was out of the room. First minute: participants had to ignore the dog, even if he/she was seeking for attention, and they could not talk to each other. Second minute: the person who sat on the left side of the one who had left the room, pulled out the shoe from the plastic bag and put it on the empty chair. Participants could talk to each other and only interacted with the dog if he/she was seeking for attention. Third minute: the person seated on the right side of the one who had left the room tried to stimulate the dog to play, with a maximum of three trials (one for each toy in the room). As soon as the dog started playing or at the end of the third trial, the stranger declared the end of the episode and called the person to come back into the experimental room.

*Episode 3:* The participant came back into the room. First minute: the person who was outside the room knocked on the door and stayed behind it for 10 seconds. At the end of that, the person entered the room and stayed for 50 seconds within 1 meter from the door, to allow the dog greeting him/her. If the dog initiated interaction, the person greeted and comforted the animal as he/she usually did when returning at home; if the dog did not approach the person, he/she had to wait the end of 50 seconds close to the door, without drawing the dog attention. Meanwhile the other participants could not speak nor interact with the dog. Second minute: the person who had just entered took the shoe off the chair and sat. Participants could talk to each other and interact with the dog only if the animal was seeking for their attention. Third minute: the person who came back in the room tried to stimulate the dog to play with a maximum of three trials (one for

each toy present in the room). As soon as the dog started playing or at the end of the third trial, the stranger claimed the episode was finished and another participant left the room.

*Episode 4: Dog alone.* After episode 3 was repeated even for the last person who had left the room (the stranger), all the participants simultaneously left the room. The dog was left alone in the room for 1 min.

*Episode 5:* All the participants came back into the room. If the dog initiated interaction with a person, he/she could greet the dog as they usually did returning home. The participants sat in the same chairs as before and made conversation, interacting with the dog only if the dog was seeking for attention. The episode 6 lasted 1 minute.

At the end of each test, the experimental room's floor was washed using a non-toxic, weakly scented disinfectant.

### Analysed behaviors

The eleven videotaped tests were analysed recording the duration (in seconds) of 19 behaviors divided into social and non-social behaviors (tables 1 and 2); each social behavior was analysed towards all the family members and the stranger. Analysed behaviors are listed in tables 1 and 2, accompanied by relative definitions and references.

**Table 1.** Non-social canine behaviors recorded in the Ainsworth Strange Situation Test.

Behaviors	Definition	Relative references
Exploration	Activity directed toward physical aspects of the environment, including sniffing, close visual inspection, distal visual inspection, and gentle oral examination such as licking	Mariti et al., 2013
Locomotion	Walking, pacing or running around without exploring the environment nor playing or following	Modified from: Prato-Previde et al., 2003
Passive behavior	Sitting, standing or lying down without any obvious orientation toward the physical or social environment	Topàl et al., 1998; Prato-Previde et al., 2003
Individual play	Any vigorous or galloping gaited behavior directed toward a toy when clearly not interacting with any participants; including chewing, biting, shaking from side to side, scratching or batting with the paw, chasing rolling balls and tossing using the mouth	Mariti et al., 2013
Proximity to the door	The time spent close to the door (<1 m) regardless to gaze orientation	Mariti et al., 2013
Behaviors towards the door	All active behaviors resulting in physical contact with the door, including scratching the door with the paws, jumping on the door, pulling on the door handle with the forelegs or mouth	Mariti et al., 2013
Oriented to door	Staring fixedly at the door, either when close to it or from a distance	Mariti et al., 2013
Behaviors towards the chair	All active behaviors resulting oriented to a family member's or stranger's empty chair	Mariti et al., 2013
Proximity to the chair	The time spent close to the empty chair	Current study
Behaviors towards the shoe	All behaviors resulting oriented to the shoe during shoe's owner absence, including staring the shoe, biting, shaking, dragging, sniffing	Mariti et al., 2013

Vocalizations	Barking, growling, howling... (excluding whining)	Modified from: Prato-Previde et al., 2003
Whining	Whining	Palestrini et al., 2010
Other behaviors	Any activity not included in the behavioral catalogue, such as self-grooming, self-scratching or drinking	Prato-Previde et al., 2003; Palmer & Custance, 2008

**Table 2.** Social canine behaviors recorded in the Ainsworth Strange Situation Test.

Behaviors	Definition	Bibliographic references
Attention seeking	Seeking attention from a person to play, be petted etc	Mariti et al., 2013
Physical contact	Being in physical contact with a family member or the stranger	Mariti et al., 2013
Following	Following the person around the room or to the door	Mariti et al., 2013
Approach	Moving towards, while clearly visually oriented to, a person	Mariti et al., 2013
Oriented to person	Staring fixedly (for a minimum 0.5 s) at a family member or the stranger, regardless of whether the behaviors was reciprocated	Mariti et al., 2013
Proximity	Close to (not in physical contact) a family member or the stranger at least for 3 seconds	Mariti et al., 2013

### Statistical analysis

The statistical analysis has been carried out on each single dog, comparing the behavior displayed by an individual dog towards/in the absence of each familiar person and the stranger.

Some behaviors have been grouped in order to create the following behavioral categories:

- contact/proximity (referred to each participant), formed by: attention seeking, physical contact, following, proximity, approach, visual orientation;
- door/chair/shoe, formed by: proximity to door/chair; behaviors towards door/chair/shoe; oriented to door.

Although behaviors grouped in categories have the same meaning, they express a different degree respectively of maintenance contact effect and protest at separation. Based on the intensity of analysed behaviors, different weights (0 to 1) have been assigned to each of them. Subsequently, the time spent displaying each behavior has been multiplied for the corresponding weight; finally, all the values have been summed, obtaining an assessment of the time spent in the maintenance contact effect and protest at separation activities which considers the intensity of displayed behaviors.

The following factors of multiplication have been assigned:

- for the category called contact/proximity to a person:
  - contact: 0.5
  - attention seeking, following and proximity: 0.2
  - approach, visual orientation: 0.1
- for the category called door/chair/shoe:
  - behaviors towards the door: 0.5
  - proximity to door and behaviors towards chair/shoe: 0.3
  - orientation to door/chair: 0.1

The statistical analysis was carried out by using the  $X^2$  test ( $p < 0.05$ ).

For each dog a score has been calculated as follow. If the value relative to a family member re-

sulted statistically higher than the value relative to at least another participant, to the first person was assigned a partial score of 1; if at least at one of the other participants corresponded a statistically significant difference compared to at least one of the remaining participants, to this person was assigned the score of 1 and to the first it was added 1 point of score. For each dog a table has been created, summarizing the results and the score obtained for each behavior/category as follow:

1. the score obtained summing the number of  $X^2$  resulted statistically higher for a specific person towards other participants for: door/chair/shoe in episodes 2 (when that person was out of the room), contact/proximity to a person in episodes 3 (when that person re-entered the room), and contact/proximity to a person in episodes 6 (when all people re-entered the room);
2. the score regarding possible differences in the dog's greeting to each participant at his/her re-entering (calculated according to Topál et al., 1998);
3. the score regarding possible differences in the dog behavioral response to play stimulation by each participant;
4. the score regarding whining duration for episodes 2;
5. the total score obtained summing scores at point 1 to 4.

A participant has been considered as the preferred by the dog when his/her total score was higher than other participants' score. In case the higher score obtained by family members was equal or lower than the stranger's score, none has been recognized as preferred person for that dog.

Regarding the questionnaires, for the current study the following items have been take into account:

1. the management of the dog: who in the family dealt with food, walking, play and training;
2. the person who, according to the respondent, was considered as the preferred one by the dog;
3. the L.A.P.S. score, calculated as in Marinelli et al., 2007. Scores obtained by preferred and not preferred people were compared using ANOVA ( $p < 0.05$ ).

## Results

Tables 3, 4 and 5 report results obtained by the analysis of videos.

**Table 3.** Results obtained for dogs living in two-people families.

Dog and owners		DCS objects Ep. 2	CP person Ep. 3	CP person Ep. 5	Whining		Greeting	Social play	Total
<b>A</b>									
AO1	Duration	11.6	40.5	0.5	3	Score	1	2	3
	Points	1	2	0	0	Points	0	0	
AO2	Duration	0.0	38.3	0.3	3	Score	1	2	1
	Points	0	1	0	0	Points	0	0	
Stranger	Duration	0.0	17.9	0.7	1	Score	1	2	0
	Points	0	0	0	0	Points	0	0	
<b>B</b>									
BO1	Duration	15.5	40.1	9.0	6	Score	3	0	2
	Points	1	0	0	1	Points	0	0	
BO2	Duration	16.5	47.4	2.1	4	Score	3	0	2
	Points	1	0	0	1	Points	0	0	
Stranger	Duration	3.0	50.4	6.9	0	Score	3	0	0
	Points	0	0	0	0	Points	0	0	

C									
CO1	Duration	22.4	14.4	9.0	2	Score	3	2	2
	Points	1	0	1	0	Points	0	0	
CO2	Duration	20.7	16.5	5.9	6	Score	3	2	1
	Points	1	0	0	0	Points	0	0	
Stranger	Duration	0.0	12.3	0.7	1	Score	3	2	0
	Points	0	0	0	0	Points	0	0	
D									
DO1	Duration	14.7	14.6	8.6	20	Score	3	2	1
	Points	0	0	0	1	Points	0	0	
DO2	Duration	12.4	13.2	14.4	8	Score	3	2	1
	Points	0	0	1	0	Points	0	0	
Stranger	Duration	9.2	14.6	5.9	10	Score	3	2	0
	Points	0	0	0	0	Points	0	0	
E									
EO1	Duration	19.1	13.0	0.2	3	Score	1	0	1
	Points	1	0	0	0	Points	0	0	
EO2	Duration	2.0	10.8	9.4	0	Score	3	2	3
	Points	0	0	1	0	Points	1	1	
Stranger	Duration	0.1	14.6	0.2	0	Score	1	0	0
	Points	0	0	0	0	Points	0	0	

**Table 4.** Results obtained for dogs living in three-people families.

Dog and owners		DCS objects Ep. 2	CP person Ep. 3	CP person Ep. 5	Whining	Greeting	Social play	Total	
F									
FO1	Duration	10.1	4.8	2.6	12	Score	1	2	1
	Points	0	0	0	1	Points	0	0	
FO2	Duration	19.9	1.8	0.4	12	Score	1	2	1
	Points	0	0	0	1	Points	0	0	
FO3	Duration	14.9	3.1	34.7	22	Score	3	2	4
	Points	0	0	1	2	Points	1	0	
Stranger	Duration	1.6	0.7	0.7	0	Score	1	2	0
	Points	0	0	0	0	Points	0	0	
G									
GO1	Duration	30.6	20.1	18.2	11	Score	3	2	5
	Points	2	1	1	0	Points	1	0	
GO2	Duration	17.3	1.4	6.1	42	Score	1	2	1
	Points	1	0	0	0	Points	0	0	
GO3	Duration	9.2	15.9	3.5	7	Score	1	2	1
	Points	0	1	0	0	Points	0	0	
Stranger	Duration	6.2	1.3	0.0	64	Score	1	2	0
	Points	0	0	0	0	Points	0	0	

**Table 5.** Results obtained for dogs living in four-people families.

Dog and owners		DCS objects Ep. 2	CP Person Ep. 3	CP person Ep. 5	Whining	Greeting	Social play	Total	
<b>H</b>									
HO1	Duration	44.5	29.0	13.0	15	Score	3	1	3
	Points	1	1	0	1	Points	0	0	
HO2	Duration	41.9	33.0	0.0	8	Score	3	2	2
	Points	1	0	0	0	Points	0	1	
HO3	Duration	35.2	67.0	0.0	4	Score	3	1	1
	Points	1	0	0	0	Points	0	0	
HO4	Duration	40.3	44.0	5.0	9	Score	3	2	2
	Points	1	0	0	0	Points	0	1	
Stranger	Duration	17.0	158.0	27.0	0	Score	3	1	3
	Points	0	2	1	0	Points	0	0	
<b>I</b>									
IO1	Duration	45.9	19.7	21.4	4	Score	3	2	4
	Points	1	0	2	0	Points	0	1	
IO2	Duration	3.8	24.1	0.0	0	Score	3	2	2
	Points	0	1	0	0	Points	0	1	
IO3	Duration	4.1	11.1	0.0	0	Score	3	1	0
	Points	0	0	0	0	Points	0	0	
IO4	Duration	43.2	38.6	5.9	17	Score	3	2	6
	Points	1	2	1	1	Points	0	1	
Stranger	Duration	0.0	66.4	0.9	0	Score	3	2	4
	Points	0	3	0	0	Points	0	1	
<b>L</b>									
LO1	Duration	19.6	19.7	9.2	0	Score	3	0	4
	Points	1	1	1	0	Points	1	0	
LO2	Duration	2.7	5.5	0.0	0	Score	3	0	1
	Points	0	0	0	0	Points	1	0	
LO3	Duration	1.0	5.3	0.0	0	Score	1	0	0
	Points	0	0	0	0	Points	0	0	
LO4	Duration	46.9	40.4	2.1	4	Score	3	0	5
	Points	2	2	0	0	Points	1	0	
Stranger	Duration	2.6	5.9	0.1	0	Score	3	0	1
	Points	0	0	0	0	Points	1	0	
<b>M</b>									
MO1	Duration	9.3	19.7	0.2	1	Score	1	0	2
	Points	0	1	0	0	Points	1	0	
MO2	Duration	43.3	13.2	10.2	0	Score	1	0	4
	Points	1	1	1	0	Points	1	0	



<b>MO3</b>	Duration	37.6	11.1	0.0	0	Score	1	0	3
	Points	1	1	0	0	Points	1	0	
<b>MO4</b>	Duration	2.1	16.3	0.0	0	Score	1	0	2
	Points	0	1	0	0	Points	1	0	
<b>Stranger</b>	Duration	9.7	3.5	0.0	1	Score	1	0	0
	Points	0	0	0	0	Points	0	0	

Notes for the tables 3, 4 and 5:

DCS = category called door/chair/shoe as described in materials and methods; CP= category called contact/proximity in materials and methods.

Duration = duration assessed as described in materials and methods; for Whining duration in seconds.

Score = score assessed as described in materials and methods.

Points = for the columns where the duration is reported, points are calculated as the number of  $X^2$  that differ between participants, as described in materials and methods; for the columns where the score is reported, points are calculated as any difference in the score obtained by each participant.

Total = total score obtained by each participant, calculated as the sum of the points in each column considered.

**Table 6.** Summary of total scores obtained in the behavioral test and data from questionnaires for dogs living in two-people families.

Dog	Family members	Family members	Management of the dog				L.A.P.S. score	Age owner	Gender owner	Preferred Person
			Food	Walking	Play	Training				
A	2	AO1	x	x	x	x	H (55)	29	M	+
		AO2	-	x	-	-	M (43)	33	F	-
B	2	BO1	x	-	-	-	H (58)	29	F	-
		BO2	x	x	x	x	H (58)	35	F	-
C	2	CO1	x	x	x	x	H (53)	33	F	+
		CO2	-	x	x	x	H (61)	33	M	-
D	2	DO1	x	x	-	-	H (59)	47	F	-
		DO2	-	-	x	x	H (63)	11	F	-
E	2	EO1	-	-	-	-	M (45)	31	M	-
		EO2	x	x	x	x	H (61)	32	F	+
F	3	FO1	-	x	x	-	H (62)	24	F	-
		FO2	-	-	x	x	H (54)	30	F	-
		FO3	x	x	-	-	H (39)	59	M	+
G	3	GO1	-	x	x	-	M (36)	31	M	+
		GO2	x	-	-	-	M (41)	61	M	-
		GO3	x	-	-	-	H (47)	54	F	-
H	4	HO1	x	x	x	x	M (36)	45	F	-
		HO2	x	x	x	x	H (43)	14	M	-
		HO3	x	x	x	x	M (39)	10	F	-
		HO4	x	x	x	x	M (43)	45	M	-
I	4	IO1	-	-	-	-	L (22)	46	F	-
		IO2	-	-	-	-	L (27)	16	F	-
		IO3	-	-	-	-	M (45)	7	F	-
		IO4	x	x	x	x	M (35)	47	M	+

L	4	LO1	-	-	-	-	M (44)	50	M	-
		LO2	-	-	-	-	H (58)	7	M	-
		LO3	-	-	-	-	H (63)	10	F	-
		LO4	x	x	x	x	H (56)	41	F	+
M	4	MO1	-	-	-	-	M (44)	49	M	-
		MO2	x	x	x	x	H (53)	10	F	+
		MO3	-	-	-	-	H (64)	8	M	-
		MO4	x	-	-	-	H (56)	42	F	-

Notes for the tables 6:

For the L.A.P.S.= it was reported the level of attachment (H: high, M: medium, L: low) and the corresponding score calculated as Marinelli et al., 2007.

For owner' gender: M: male, F: female.

Regarding exploration, each dog showed its own trend in exploring the room. Overall, a strong reduction was observed between the episode 1 and 2.1, but no statistical difference was found between the duration of exploration when comparing episodes in which a certain participant was present versus when he/she was absent. In addition, no difference was observed in the comparison of episodes in which one participant versus another one were present. A trend of increased exploration emerged when the preferred person (found as described in tables 3, 4 and 5) re-entered the room, regardless of the order owners left the room: even in case the preferred person was the fourth leaving the room, the dog explored more after that family member was back.

Also concerning individual play, each dog displayed it in his/her own way (e.g. some of them did not play at all), and statistically significant differences were not found comparing presence to absence of each participant and comparing the presence of each participant to the others. But a trend of increased individual play was observed when one or more owners were present compared to their absence.

The analysis of behaviors such as locomotion, passive behaviors and vocalisations did not lead to relevant results.

Data elaborated through the analysis of videos, as well as data obtained by questionnaires, are reported and summarized in table 6.

The analyses revealed that 8 dogs out of 11 (72.7%) showed a preference for a person within the family. Among the remaining three pets, two of them lived in a two-people family (dogs B and D) and the third in a four-people family (dog H, for whom the higher total score obtained by an owner was equal to the total score of the stranger).

Considering dogs that showed a preference for a family member, 4 were more bonded to a female (on 13 women) and 4 to a male (on 11 men): therefore, the gender of people was not an important factor ( $X^2=0.043$ ;  $p=0.835$ ). Regarding the age, it did not emerge a preference for a specific range, as dogs show a stronger bond for people ranging from 10 to 65 years old.

Matching data obtained through questionnaires and behavioral tests, owners usually (24 on 32; 75.0%) seemed to be able to identify the person the dog was more bonded to.

It was not found a correlation between the level of attachment of a specific owner to the dog and the preference of this dog to that specific owner. As a matter of fact, considering only the owners of dogs who showed a preference ( $n=8$ ), no difference was observed regarding the L.A.P.S. score between preferred and not preferred people ( $57.12\pm 15.42$  versus  $58.00\pm 18.95$ ;  $F=0.00$ ;  $p=0.955$ ).

Finally, six on eight preferred owners (75.0% considering only dogs who showed a preference) were the ones who managed the dogs almost totally by themselves; the other two walked the dog and shared other activities with the rest of the family. The dog living in a four-member family who did not show a preference was equally managed by all people.

## Discussion

The novelty of the current study consisted in considering the dog as part of a family group: therefore, dog bond to all family members, and not just to one of the owners, has been analysed. Considering the small sample size of this pilot study, results have to be discussed cautiously and not to be regarded as conclusive. However, preliminary data suggest that most dogs living in a multi-member family show a stronger bond to a specific member.

It is possible that results are influenced by the routine of owners' exits. This factor, that was not possible to investigate in the current research, may be responsible for a lower excitement shown by the dog at the exit and re-entrance of a person, although strongly linked to him/her. However, the ASST has been shown to challenge enough the dog because it is performed in an unknown environment, and dogs usually are not used to see their owners going away in an unusual and unknown place. An example is represented by the display of whining.

Whining was almost absent in the first and in the last episode, when all people were present, while it can be observed an increase when one of the owners (or two) left the room and a second increase, particularly high, during the complete isolation. The increase of whining can be considered as an indicator of stress caused by separation (Palestrini et al., 2010); its display at the exit of a specific person, although the rest of the family was within the room, is likely to be related to a stronger bond to that person.

It could also be hypothesized that the repetition of the exiting-entering procedure may progressively get the animal used to this event and therefore showing lower signs of separation distress from time to time. This was not observed indeed, as peaks of time spent close to the door were observed also for the last person who exited (e.g. for dogs I and L).

Based on what Bowlby & Ainsworth observed in children (Ainsworth & Bell, 1970; Bowlby, 1988), also in dogs exploration and individual play are behaviors indicative of the secure base effect, being more displayed in the presence of the attachment figure (Mariti et al., 2013) regardless of the order of execution of episodes (Palmer & Custance, 2008). As for exploration, in the current research it was observed that such behavior had a high spike during the first episode, then a rapid decline, but the following trend is very variable according to the examined subject, achieving the minimum when dogs are in complete isolation. A second spike was observed at the re-entering of a specific owner, regardless of the order he/she left the room, suggesting that this person was the attachment figure and that he/she could act as a secure base. The same results were found for individual play. Although the statistical analysis did not provide significant results, such results suggest that most dogs living in a multi-member family use one owner as a secure base.

Results of the current study suggest that 8 out of 11 tested dogs (72.7%) showed a stronger bond towards one of the owners, while 3 of them did not show a preference for a certain member of the family.

In the protocol used for the current research, the stranger was always played by the same person, a woman. This choice was made in order to match previous studies on dog attachment to people, and it is justified by the fact that women appear to be preferred by dogs when approached or touched (Hennessy et al., 1998; Wells & Hepper, 1999). As for interactions of men and women with their own dog, Prato-Previde and colleagues (2006) only found a gender-related difference in the use of verbal communication, more relevant for women, while they do not differ for play and affiliative behaviors. Such lack of difference may explain what observed in the current study for the gender, that did not result a discriminating factor for dogs' preference. Unfortunately, it was not possible to assess a possible preference based on dog sex, due to the small sample and the disparity in the number of tested female and male dogs.

Comparing data obtained for the L.A.P.S. and the results of the behavioral tests, it did not emerge a correlation between the level of attachment of a specific owner to his/her dog and the dog bond towards that specific owner. It may be hypothesized that the level of attachment of a

person to the dog is not necessarily related to the behavior he/she shows to the dog, and consequently dog bond to that person may not be highly affected by that factor *per se*.

Differently from what observed by Topál et al., (1998), it was not observed a reduction in the contact/proximity to door/chair/shoe when increasing the number of family members. From tables 3, 4 and 5, it emerged instead that, as reported by Bowlby in children, in dogs living in three or four-people families who showed a preferential attachment, it was possible to observe a kind of hierarchy in the level of attachment towards different owners, with high scores corresponding to one or two owners and low scores corresponding to the others. This does not imply that dogs living in numerous families do not show a lower attachment, as suggested by Topál et al. (1998). It may mean instead that in research on dog attachment to people great attention has to be paid to the person chosen as the attachment figure to be tested. According to the current research, basing the choice on owners' perception may lead to a mistake in 25.0% of cases.

The higher score sometimes obtained by the stranger compared to one or more members of the family can be probably explained by dogs' curiosity and good socialization. The stranger was always played by a woman that, as previously mentioned, belong to the sex dogs prefer to be approached by. As already reported by Palmer & Custance (2008), the majority of tested dogs have approached or sought contact with the stranger since the beginning of the test, as well as when she re-entered the room. Dogs' behavior in this condition is very different from the children's one that, at the stranger entrance, often show behaviors such as turning attention to their mother or going towards them, interpreted as signs of fear of the unknown person (Ainsworth & Bell, 1970). This behavior is normal in well-socialized adult dogs and usually observed in the ASST performed with dogs (Mariti et al., 2014).

A very interesting result concerns the correlation found between the preferred figure of the dog and the role of this person in the management of the dog. In 75.0% of cases the preferred person was the one who almost completely managed the dog; for the remaining two dogs it did not exist such an exclusive relationship, and dogs showed to prefer the person within the family who dealt with walking and food or walking and play. Therefore, for all dogs who showed a preference, being walked by a person appeared as a predisposing factor for establishing a stronger bond. Walking resulted more important than food, play and education, maybe for the benefits dogs gain from it: exercise, social interaction with people and dogs, and environmental stimulation. It is common opinion that maintaining dogs always leashed could diminish such benefits (Bekoff & Meaney, 1997), and in general the increase of shared activities, especially walking, is at the top of advice provided by behaviorists where the relationship needs to be strengthened. As a matter of fact, it has been demonstrated that the dog-owner relationship is more affected by the quality rather than the amount of time spent together (O'Farrell, 1992; Rooney & Bradshaw, 2003; Scott & Fuller, 1958), and the act of feeding is a minor part of the relationship, that does not produce a strong emotional response out of feeding time (Scott & Fuller, 1958).

Although food probably plays an important role in creating affection or anyway a positive interest of dogs towards a specific person (that in this case could be simply explained as classic conditioning), establishing an attachment bond seems to be based on different factors, unrelated to the primary drive of feeding. This is what Bowlby (1988) suggested in his theory of attachment, that seems to perfectly fit also dog-human relationship.

## Conclusions

Results suggest that most dog living in a multi-member family show a stronger bond to a specific person in that family, namely that involved in managing the dog, especially walking. Further research is needed to assess the possible influence on dog attachment to people of dog sex, age and breed, besides the duration of living within the family.

## References

- Ainsworth M.D., Bell S.M. Attachment, exploration, and separation: illustrated by the behavior of one-year-olds in a strange situation. *Child Dev.* 1970. <https://doi.org/10.1111/j.1467-8624.1970.tb00975.x>
- Bekoff M., Meaney C.A. Interactions among dogs, people, and the environment in Boulder, Colorado: A case study. *Anthrozoos.* 1997. <https://doi.org/10.2752/089279397787001346>
- Bowlby J. *A Secure Base: Clinical Applications of Attachment Theory*, London, Routledge, 1988.
- Gácsi M., Topál J., Miklósi Á., Dóka A., Csányi V. Attachment behavior of adult dogs (*Canis familiaris*) living at rescue centers: Forming new bonds. *J. Comp. Psychol.* 2001; 115: 423-431. <https://doi.org/10.1037/0735-7036.115.4.423>
- Hennessey M.B., T. Williams M., Miller D.D., Douglas C.W., Voith V.L. Influence of male and female petters on plasma cortisol and behavior: Can human interaction reduce the stress of dogs in a public animal shelter? *Appl. Anim. Behav. Sci.* 1998. [https://doi.org/10.1016/S0168-1591\(98\)00179-8](https://doi.org/10.1016/S0168-1591(98)00179-8)
- Johnson T.P., Garrity T.F., Stallones L. Psychometric Evaluation of the Lexington Attachment to Pets Scale (Laps). *Anthrozoos.* 1992. <https://doi.org/10.2752/089279392787011395>
- Marinelli L., Adamelli S., Normando S., Bono G. Quality of life of the pet dog: Influence of owner and dog's characteristics. *Appl. Anim. Behav. Sci.* 2007. <https://doi.org/10.1016/j.applanim.2006.11.018>
- Mariti C., Carlone B., Ricci E., Sighieri C., Gazzano A. Intraspecific attachment in adult domestic dogs (*Canis familiaris*): Preliminary results. *Appl. Anim. Behav. Sci.* 2014; 152. <https://doi.org/10.1016/j.applanim.2013.12.002>
- Mariti C., Carlone B., Votta E., Ricci E., Sighieri C., Gazzano A. Intraspecific relationships in adult domestic dogs (*Canis familiaris*) living in the same household: A comparison of the relationship with the mother and an unrelated older female dog. *Appl. Anim. Behav. Sci.* 2017; 194. <https://doi.org/10.1016/j.applanim.2017.05.014>
- Mariti C., Ricci E., Zilocchi M., Gazzano A. Owners as a secure base for their dogs. *Behavior* 2013; 150. <https://doi.org/10.1163/1568539X-00003095>
- O'Farrell V. *Manual of canine behavior*. 1992, Second Ed. 132 pp.
- Palestrini C., Minerò M., Cannas S., Rossi E., Frank D. Video analysis of dogs with separation-related behaviors. *Appl. Anim. Behav. Sci.* 2010. <https://doi.org/10.1016/j.applanim.2010.01.014>
- Palmer R., Custance D. A counterbalanced version of Ainsworth's Strange Situation Procedure reveals secure-base effects in dog-human relationships. *Appl. Anim. Behav. Sci.* 2008. <https://doi.org/10.1016/j.applanim.2007.04.002>
- Payne E., Bennett P., McGreevy P. Current perspectives on attachment and bonding in the dog&ndash;human dyad. *Psychol. Res. Behav. Manag.* 2015; 8, 71. <https://doi.org/10.2147/PRBM.S74972>
- Prato-Previde E., Fallani G., Valsecchi P. Gender differences in owners interacting with pet dogs: An observational study. *Ethology.* 2006. <https://doi.org/10.1111/j.1439-0310.2006.01123.x>
- Rooney N.J., Bradshaw J.W.S. Links between play and dominance and attachment dimensions of dog-human relationships. *J. Appl. Anim. Welf. Sci.* 2003. [https://doi.org/10.1207/S15327604JAWS0602\\_01](https://doi.org/10.1207/S15327604JAWS0602_01)
- Scott J.P., Fuller J.L. Genetics and social behavior in dogs. *Proceedings.* 10<sup>th</sup> int. Congr.Genet. 1958.
- Topál J., Miklósi Á., Csányi V., Dóka A. Attachment Behavior in Dogs (*Canis familiaris*): A New Application of Ainsworth's (1969) Strange Situation Test. 1998; 112: 219-229.
- Wells D.L., Hepper P.G. Male and female dogs respond differently to men and women. *Appl. Anim. Behav. Sci.* 1999. [https://doi.org/10.1016/S0168-1591\(98\)00202-0](https://doi.org/10.1016/S0168-1591(98)00202-0)

Il cane (*Canis familiaris*) come parte della famiglia:  
uno studio pilota sull'analisi del legame del cane con tutti i proprietari

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*Sintesi*

Lo scopo del presente studio è stato quello di valutare se i cani che vivono in una famiglia con diversi membri mostrino un legame più forte nei confronti di una persona specifica e, in questo caso, quali caratteristiche del proprietario o della relazione portino a tale preferenza.

Sono stati testati 11 cani, usando una versione modificata del Strange Situation Test di Ainsworth in cui tutti i membri della famiglia (5 famiglie di 2 componenti, 2 con 3 membri e 4 con 4 componenti) erano presenti contemporaneamente. È stata misurata la durata di 19 comportamenti sociali e non sociali del cane. I comportamenti sociali sono stati verificati nei confronti di ogni membro della famiglia presente.

Per ottenere informazioni sulla relazione tra le persone ed il cane testato. È stato utilizzato un questionario che includeva la Lexington Attachment to Pets Scale.

L'analisi dei dati ha rilevato che la maggior parte dei cani ( $n = 8$ ; 72,7%) che vivono in una famiglia con più membri, mostrano un legame più forte nei confronti di un membro particolare. I proprietari sono in grado solitamente (75%) di individuare la persona a cui il cane è maggiormente legato.

Non è stata trovata alcuna correlazione tra il livello di attaccamento di uno specifico proprietario ed il legame del cane a quella persona ( $52,12 \pm 15,42$  versus  $58,00 \pm 18,95$ ;  $F = 0,00$ ;  $p = 0,955$ ).

Tra i cani che hanno mostrato una preferenza, la maggioranza ( $n = 6$ ; 75,0%) preferiva la persona che si prendeva cura di loro quasi esclusivamente; gli altri due preferivano la persona che in famiglia si occupava delle passeggiate e del cibo o delle passeggiate o del gioco.

Perciò, questi dati sembrano avvalorare l'ipotesi che portare il cane a compiere la passeggiata quotidiana aumenti la possibilità di stabilire un forte legame con l'animale.